

## **AHRQ Grant Final Progress Report**

**Project Title:** Improving Anxiety Detection in Pediatrics Using Health Information Technology

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**Organization:** Indiana University School of Medicine

**Inclusive Dates of Project:** 9/1/2015-8/31/2018

**Federal Project Officer:** Ed Lomatan, MD

**Acknowledgement of Agency Support:** Agency for Healthcare Research and Quality R21HS024314

**Grant Award Number:** 1R21HS024314-01 REVISED

## Structured Abstract

**Purpose:** To determine whether integrating an anxiety specific validated screener into an existing computer decision support system (CDSS) facilitate providers' ability to identify and address anxiety among children presenting with inattentive behaviors.

**Scope:** To revise an existing module for attention deficit hyperactivity disorder (ADHD) with iterative end-user input followed by the conduct of a randomized feasibility pilot at four urban pediatric clinics.

**Methods:** Aim 1- Expand and modify the CHICA decision support system to improve the diagnostic processes for screening of children with inattention, including screening in the waiting room, physician prompts, and tailored diagnostic and brief counseling tools. Aim 2- Improve provider awareness of identification and referral patterns for children presenting with inattentive symptoms by providing run charts of clinic practice patterns paired with facilitated discussion to share strategies to improve diagnostic process and obtain preliminary feedback for future health IT development of a comprehensive anxiety module. Aim 3- Examine the effect of the CHICA anxiety module on the diagnostic processes of physicians when screening children with inattentive symptoms.

- Sub-aim 3(a): Evaluate agreement between positive anxiety screening results by the Vanderbilt and a validated anxiety-specific screening tool.
- Sub-aim 3(b): Evaluate actions taken by providers when prompted to results of a positive screen.
- Sub-aim 3(c): Compare rates of ICD-9 diagnoses of anxiety and ADHD using billing data and rates of psychotropic medication using e-prescribing data.

**Results:** Preliminary trends are included in the report; qualitative and quantitative analyses were mixed as to the final impact of the revised module on general trends to improve anxiety detection in pediatric primary care using the CDSS. Important key implementation barriers and facilitators that ultimately impacted the uptake of the revised module and, ultimately, our findings, are discussed.

**Key Words:** Anxiety; Screening; Computerized Decision Support; ADHD; Primary Care

## PURPOSE

The identification of mental health and behavioral (MHB) disorders and need for treatment is increasing at an alarming rate. More than 1 in 10 children were diagnosed with attention deficit hyperactivity disorder (ADHD) by their health care providers in 2011, representing an increase of 42% since 2003. However, while physicians embrace the need to identify ADHD and start medication, it is likely that some children are misclassified and receive inappropriate treatment. Physicians face numerous challenges when evaluating children with inattentive symptoms: MHB disorders are complex; there is no specific test to confirm diagnosis; and children present with similar caregiver concerns. These behaviors are also observed among children with anxiety, which is even more common than ADHD but is under-diagnosed and can co-occur with ADHD. Over time, children with unrecognized anxiety may be prescribed different ADHD medications or even multiple psychotropic medications for persistent inattentive symptoms.

Primary care physicians act as gatekeepers for the more complex and time-consuming medical and MHB concerns. They need tools to facilitate screening given the high volume of outpatient practice. Health information technology (HIT) has been used to improve healthcare quality and delivery in pediatrics. Given that ADHD is increasingly diagnosed and treated in primary care, it is prudent to leverage existing HIT applications to improve the diagnostic processes for inattentive symptoms so that children are screened efficiently while decreasing the risk of misclassification.

This study sought to refine an existing module for ADHD identification and management to improve the diagnostic processes to include consideration of pediatric anxiety within the Child Health Improvement through Computer Automation (CHICA) system. The ADHD module includes a set of rules for pre-screening in the waiting room, an electronic version of the Vanderbilt ADHD Diagnostic Rating Scale (Vanderbilt) that is completed by the parent while at the clinic and faxed back and transmitted to CHICA servers by the teacher, and alerts and prompts for the provider to guide medical decision making.

Given the high volume of patients seen typically in outpatient primary care practice, we sought to be mindful of the needs of the end users (providers and clinical staff) as well as meeting the families' needs. Therefore, we incorporated specific methods to solicit and incorporate stakeholder feedback throughout the study.

The objective of this application was to refine CHICA to improve the diagnostic process of screening children with inattentive symptoms by employing iterative quality improvement strategies with physician and clinic users and periodic family feedback about the screening process itself. The central hypothesis is that by refining current diagnostic processes within CHICA, we will improve the identification of anxiety among children with inattentive symptoms, decrease the inappropriate diagnosis of ADHD, and improve overall treatment for children with inattention. The rationale for this application is that the current care of children with inattentive symptoms is a constant challenge for busy primary care physicians and results in suboptimal identification and treatment.

The specific aims of this study included a set of 3 aims. The first was to expand and modify the CHICA decision support system to improve the diagnostic processes for screening of children with inattention, including screening in the waiting room, physician prompts, and tailored diagnostic and brief counseling tools (Aim 1). After the technical changes were completed, tested and approved by end users we launched the randomized pilot study over the period of the subsequent 12 months. Once deployed we sought to improve physician awareness of identification and referral patterns for children presenting with inattentive symptoms by providing run charts for each clinic of the screening, referral and medication prescribing patterns paired with facilitated discussion to share strategies to improve diagnostic process and obtain preliminary feedback for future health IT development of a comprehensive anxiety module (Aim 2). At the end of 12 months, we sought to examine the effect of the CHICA anxiety module on the diagnostic processes of physicians when screening children with inattentive symptoms (Aim 3). More specifically, Aim 3 was comprised of 3 sub-aims: Sub-aim 3(a): Evaluate the agreement between positive anxiety screening results obtained by the Vanderbilt and a validated anxiety-specific screening tool; Sub-aim 3(b): Evaluate the actions taken by pediatricians when prompted to results of a positive screen; and Sub-aim 3(c): Compare rates of ICD-9 diagnoses of anxiety and ADHD using billing data and rates of psychotropic medication (stimulants for ADHD versus anxiolytics for anxiety) using e-prescribing data.

## SCOPE

Background/Context: Childhood mental health and behavioral (MHB) conditions are identified in primary care settings at an increasing rate. The most commonly recognized childhood MHB is attention deficit hyperactivity disorder (ADHD). Since 2001, when clinical care guidelines were published to help primary care providers identify ADHD early and initiate treatment, identification in this setting has increased. While this may reflect adherence to evidence-based guidelines, the rate at which ADHD is identified and the subsequent rise in psychotropic medications among our youth is alarming.

It is not uncommon for children with ADHD to have co-existing conditions such as anxiety, depression or learning disabilities with ADHD often presenting first. ADHD and anxiety often share behaviors of inattention as the presenting complaint, yet the treatment is quite different. Pediatric anxiety is even more prevalent than ADHD, but often goes undetected and untreated. Failing to identify anxiety early in childhood can lead to increased symptoms, depression, substance abuse later and educational underachievement. Furthermore, primary care physicians may treat children with unrecognized anxiety using medications for ADHD with little success, resulting in use of multiple psychotropic medications for persistent symptoms. Polypharmacy is a significant concern that is highly prevalent among youth with MHB conditions and can raise the risk of adverse side effects and compromise patient safety.

In order to improve the detection of ADHD and co-morbidities and prevent undue polypharmacy, validated screening tools are essential in the primary care setting. Yet given the fast pace of primary care practice, providers need help streamlining surveillance and screening for common health conditions. While screening tools exist for pediatric MHBs, it can be cumbersome and difficult for providers to remember which tool to use when. The Vanderbilt ADHD Diagnostic Rating Scale is for parents and teacher to complete and is a common screening tool used in community pediatric practices for the identification of ADHD. It also has a comorbidities scale to detect anxiety, depression, oppositional defiant disorder and conduct disorder. Our group has completed prior work examining the utility of using CHICA and the Vanderbilt to identify ADHD and other co-morbidities. Sixteen percent of children whose parents completed the Vanderbilt for concerns of disruptive behavior had a positive anxiety screen. However, it was noted that Hispanic families were less likely to report symptoms of anxiety compared to white and black families (Bauer et al, JDBP, 2016). This study underscored the value of considering cultural factors, but also that specific conditions can be overlooked if clinics utilize limited or no screening tools for behavioral conditions. It is with this context that our group set about incorporating the anxiety-specific screening tool, the Screen for Childhood Anxiety Related Emotional Disorders (SCARED) into the CHICA system.

Setting: This study was conducted in four urban community health clinics that are part of the Eskenazi Health system, which serves as a safety net healthcare system in Indianapolis, Indiana.

Participants: Eligible child subjects for this study included those receiving routine medical care during the study period at one of the four participating study clinics between the ages of 6 and 12 years of age whose parents/caregivers had concerns of inattention and disruptive behaviors.

Eligible caregiver subjects for this study included caregivers of children seen at the participating study clinics, with symptoms of inattention/disruptive behaviors that trigger the ADHD module per standardized algorithm.

Eligible providers are all physicians, nurse practitioners, practicing in the participating study clinic sites.

## METHODS

Study Design: The study was done in two phases. The first phase, the anxiety module development phase, occurred during Year 1, Months 1-6. This phase included two CHICA user group (CHUG) meetings at each of the two intervention clinics to obtain input into needs of the module, workflow concerns and feedback on existing educational tools and resources. At each subsequent visit to the intervention clinics, revised algorithms for the anxiety module were presented

and reviewed in light of clinic workflow, as well as patient handouts for ADHD and anxiety. Special consideration was taken with respect to providers' needs when caring for Spanish-speaking families and identification of anxiety or ADHD.

The second phase was a randomized feasibility pilot, which occurred over Year 1, Month 7 through Year 2, Month 6. Two clinics served as the intervention clinics and two served as control. While the unit of randomization occurred at the clinic level, the unit of analysis was at the patient level. Allocation of the clinics to intervention or control will involve a pseudo-randomization scheme in which the clinics will be matched in pairs to create a balance of patient numbers and percent of caregivers who complete CHICA forms in Spanish. A coin flip determined which clinic pair received the intervention and which served as control.

Intervention clinics had access to CHICA and the revised ADHD+ anxiety module (as described below). The control clinics had access to CHICA and the usual ADHD module, which was comprised of a set of pre-screening questions for the family to complete in the waiting room (3 items: makes careless mistakes, difficulty remaining seated, hard time paying attention). If any two of the 3 items were positive, then the Vanderbilt form for the parent was printed and given to the family to complete and then scanned back in. The teacher Vanderbilt was given to the parent to hand to the school. The ADHD module also included a set of physician prompts and alerts to guide medical decision making and educational handouts for the provider to use when counseling the family after a positive screen.

Intervention: The CHICA system is a pediatric primary care computer based decision support system (CDSS) first deployed in 2004 and described in detail in numerous existing publications. CHICA automates surveillance and screening for preventive and disease management with pre-screening items, just in time handouts, physician prompts and reminders at the point of care. Families are provided a tablet upon check in that generates a tailored set of 20 questions on the prescreening form (PSF) based on age-appropriate clinical guidelines and data contained in the patient's electronic health record. All PSF items are yes/no items completed by the parent or adolescent (ages 12 and older) in the waiting room. PSF items are available in English or Spanish based on caregiver preference. Once completed, answers are immediately transmitted to the CHICA database. Depending on the responses, CHICA then will display up to 6 alerts and prompts for the provider on the physician worksheet (PWS) that is web-based and accessed via the provider's laptop. Each alert has 6 checkboxes that allows providers to document clinical decision making. These responses are then transmitted back to CHICA. Observations within CHICA are used to pre-populate physician notes in the electronic health record (EHR).

Aim 1 of the study resulted in the revision of the ADHD module, which is programmed to begin surveillance starting at age 5 years with 3 items are generated annually. The module was revised to include an anxiety specific validated screening tool, the Screen for Childhood Anxiety Related Emotional Disorders (SCARED), which has 41 items. CHICA automatically scores the SCARED and generates a report with interpretations. In addition, a family friendly one page JUST IN TIME handout is available to print and provide the family on pediatric anxiety and what to expect next (see below).

After these pre-implementation CHUGs, the technical team checked the rules and tested the module before deployment in March 2016. The revised module was officially deployed March 23, 2016 through March 22, 2017 during phase two of the study. The study team had quarterly CHUG meetings throughout to monitor revised module usage and provide feedback based on CHICA data and parent interviews (see below).

#### Data Sources/Collection/Measures and Limitations:

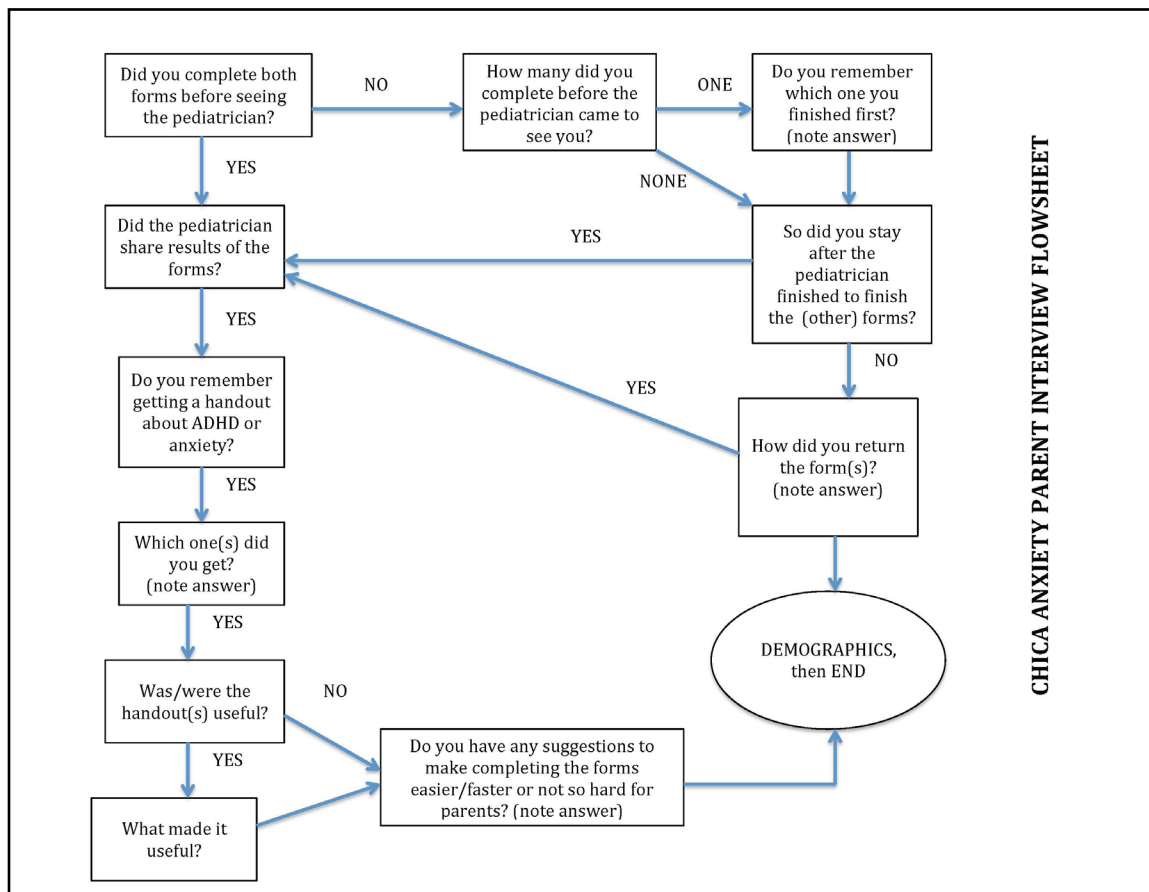
Once the revised module was deployed, CHICA began to store data about the number of eligible children for screening for inattentive/disruptive behavior; the number of children whose parents endorsed concerns that triggered the module; the number of children whose SCARED-5 were positive; the number of children for whom a SCARED 41 was generated; and finally, the number of children whose SCARED 41 was positive. In addition, similar data were being stored regarding ADHD.

For the intervention clinics, the study team presented CHICA data reflecting the prior 3 months of usage as run charts. These data were presented as run charts of Anxiety screening by month (SCARED 5 generated vs. positive SCARED 5 vs.

positive SCARED 41) as well as whether actions were taken after a positive SCARED 41 with mental health referral as documented within CHICA. By displaying progress at quarterly intervals to the intervention clinics, discussing concerns and troubleshooting technical issues, we had hoped to optimize the use of the revised CHICA module. Caregiver Interviews: For Aim 2 we had proposed to interview 20 caregivers among a random subsample of families whose concerns had triggered the revised anxiety module. Families were called within 2 weeks of the index visit to ascertain their experience with the revised module. It was important to obtain family feedback about the screening workflow from the family perspective and share this information with the providers at the intervention clinics.

PResNet executed telephone interviews after obtaining a list of eligible patients each week from CHICA. Families were called up to 3 times. Interviews were conducted in English or Spanish. See *Figure 1* for the interview flowchart to obtain feedback from caregivers and their experience with the revised CHICA module.

**Figure 1: Interview Flowchart regarding caregiver experiences with revised CHICA module**



In addition, physician acceptance of the revised CHICA module was obtained via quantitative surveys addressing physician comfort with anxiety and ADHD identification and acceptance of the anxiety module. Provider surveys were obtained twice during the course of the study timeline during annual administration of the annual CHICA Satisfaction survey as part of a larger quality improvement process. All providers and staff practicing at a CHICA site were eligible to complete the annual surveys by default. The satisfaction survey includes 20 likert-style questions regarding satisfaction, and 7 demographic questions regarding gender, clinic, years in practice (if non-trainee), residency year (if in residency), primary specialty, number of patients seen per week and % time spent in clinic. Surveys required 10-15 minutes to complete. PResNet staff was responsible for data entry and reporting data to study investigators.

Three specific items were included in the 2016 and 2017 annual CHICA Satisfaction survey: 1) CHICA helps me distinguish anxiety from ADHD for children with inattentive behaviors; 2) CHICA reminds me to make referrals for children with

anxiety to mental health when needed; and 3) CHICA makes choosing medications easier for children with inattentive behaviors. Each item was rated between a 5-point scale of 5= Strongly agree to 1=strongly disagree.

Identification of Anxiety and ADHD: A central outcome of interest for Aim 3 is the number of children with inattentive behaviors who screen positive for anxiety, ADHD or anxiety and ADHD. Once implemented, CHICA data was collected and stored on the total children eligible for screening based on caregiver endorsement of 2 of 3 PSF module items, the number of children with completed SCARED 5 and SCARED 41 screens, and the number of children with completed parent and teacher Vanderbilt screens.

Actions Taken by Providers: If a child screened positive for ADHD or Anxiety, a specific PWS prompt for either condition was displayed on the PWS. Providers were reminded to review the screen with the family and indicate whether results indicate anxiety/ADHD (as correlated with history taken by the provider) or not as well as provider actions (whether a referral for mental health was made, whether medication was initiated, and whether the respective JUST IN TIME handout was provided), see Figure 2 below.

Reportedly [CHILD's name] has inattentive symptoms, which may imply anxiety OR ADHD. Both SCARED and Vanderbilt screening suggested (CPT 96127). See separate PWS ADHD prompt.

<input type="checkbox"/> SCARED results indicate anxiety →	<input type="checkbox"/> Referral to Midtown
<input type="checkbox"/> Hx suggest poor fxn 2/2 anxiety	<input type="checkbox"/> Anxiety JIT provided
<input type="checkbox"/> No anxiety suspected	<input type="checkbox"/> Schedule F/U 1 month

**Figure 2: Anxiety PWS Prompt**

The ADHD PWS prompt was not altered at any time point during the study. If the Vanderbilt was printed based on any 2 of the 3 positive PSF items being endorsed, the provider got an alert similar in structure to the anxiety PWS but with the option to indicate the following: 1) ADHD H&P; 2) Parent Vanderbilt done; 3) Vision & Hearing Screen; 4) Teacher Vanderbilt sent; 5) CHICA ADHD Dx, no; or 6) Follow up 2 weeks scheduled. For younger children, an option to check referral to mental health was substituted for H&P, otherwise all other response options were the same.

Visit claims data of the ICD-9 diagnoses for ADHD or anxiety and e-prescribing data for any of the common psychotropic medications for these conditions after the index visit will be extracted from the Indiana Network for Patient Care (INPC) database through our collaboration with Regenstrief Institute. These data were linked with CHICA data prior to end of study analysis.

Unfortunately, during the second year, the study team did not get the administrative data from Regenstrief in a timely manner due to several administrative issues. When the final data set was obtained, it was also noted that much of the data were missing for a large percentage of our cohort. This was unfortunately due to not obtaining Medicaid data agreement approval. However, the study team approached Medicaid directly for access to the data and we were able to analyze this new data set.

Given the difficulties in optimizing the use of the revised module during the 12 months of the study, the study team opted to conduct formal implementation interviews with the intervention sites to understand barriers and facilitators of adoption and use of this revised module in context of the transition to Epic. A secondary aim was to understand potential future directions from the stakeholders' perspectives. Questions from the meta-theoretical framework, Consolidated Framework for Implementation Research (CFIR), were used to develop the interview guide for qualitative data collection and analysis. The CFIR is meant to guide how implementation is planned, organized and conducted.<sup>1</sup> Our study will utilize suggested questions that tap into the following domains: (1) intervention, (2) inner setting (internal context), (3) outer setting (external context), (4) the individuals involved and (5) process by which implementation is accomplished. This framework helps to identify potential influences of implementation and will provide key insights into adaptations across sites and implementation fidelity.

We conducted qualitative interviews with clinicians and staff at both intervention sites to better understand the obstacles encountered, what should be considered prior to launching a more comprehensive module, and ongoing

needs to providing care for children at risk of having anxiety, ADHD or both. We also invited the co-located Midtown community mental health providers to participate in these interviews to understand how the revised module influenced their interactions with the pediatric clinic team. Interviews were conducted in small groups—one for each clinic group: pediatric providers at both intervention sites and Midtown providers.

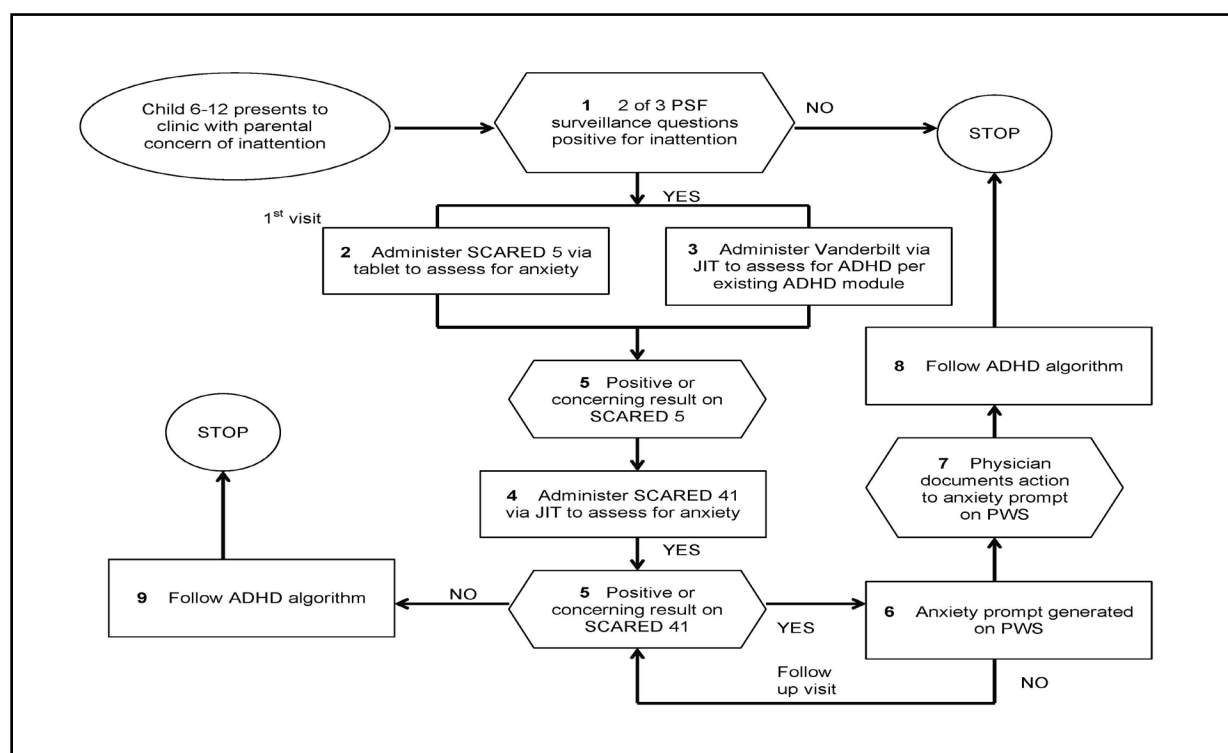
Interviews were transcribed and analyzed by two study team members who independently reviewed all transcripts before initial coding and performed open coding, using concepts grounded in the interview instrument and CFIR framework for guidance. The coders met to compare notes and refine definitions and discuss application of the CFIR constructs and maintained a provisional list of codes and then independently coded the three transcripts. Disagreements were resolved through discussion. CFIR constructs were used to organize the data to understand patterns of barriers and facilitators relating to the implementation of the revised CHICA module.

## RESULTS

**Phase One:** Clinicians were eager to provide feedback about the module. The first round of pre-implementation CHUGs was held in November 2015 to present anxiety module plans and solicit initial feedback on the algorithm and impact on workflow. The most salient suggestion that was voiced at both intervention sites was to reduce respondent burden by making anxiety screening a two-step process to minimize clinic workflow disruptions. This would also alleviate burdening the families as the 20-item PSF was completed prior to both the Vanderbilt or SCARED forms on the same day. The proposed solution was to insert the SCARED-5, which is an ultra-brief screening tool validated from the original SCARED 41 by the developer, Dr. Birmacher into the workflow. If the SCARED-5 was positive then and only then would the SCARED 41 be generated and given to the family.

*Figure 3* reflects the final CHICA ADHD + Anxiety module for intervention clinics based on the feedback provided by the two intervention clinics. Additional considerations raised was the content of the JUST IN TIME (JIT) handout, specifically for Spanish speaking families. Time was spent on reflection of appropriate words to use when talking about anxiety and cultural considerations providers acknowledged that comes with providing culturally sensitive care to families.

The second pre-implementation CHUG occurred in January 2016 to get review feedback regarding content for the JUST IN TIME handout. Key words and phrases, as well as the need to keep messaging as simple as possible for literacy issues were compiled and a mock up of the JUST IN TIME handout was provided at the second round of pre-implementation CHUGs for feedback and final revisions. Similar discussions about the JUST IN TIME handout for ADHD were also reviewed at the CHUGs and the handout underwent a similar process.



**Figure 3.**  
**FINAL REVISED**  
**MODULE**  
**ALGORITHM**



When both handouts were approved, they were sent for translation and reformatted so to be consistent with the visual layout of the English version handouts (See *Figures 4 & 5*). Both were then integrated and programmed into CHICA for provider access when screens for ADHD or anxiety were positive.

**Figure 4. Anxiety JIT handout**

**Know the FACTS**

## Helping Your Child Who Worries: A Parent Guide

Children who worry may not know how to tell us how they feel. Instead, they use their bodies to show us.

**Signs of Worry**

- Mood Swings
- Argues all the time
- Wants to do things their way
- Gets upset easily
- Problems separating
- Headaches or stomach aches
- Does not like change
- Does not want to go to school
- Sleep problems

**When kids worry too much, it can cause problems at home & school. This is when it can become ANXIETY.**

Kids look to their parents to feel safe & secure. If parents are worried, kids will be worried too. If you need help for yourself, just ask us.

**U1 Describe child's feelings**

"It looks like you are frustrated. How can I help?"

"You look excited! Tell me why!"

"You are upset. I am here."

"Oh wow, you must feel proud of yourself right now!"

**U2 Share your feelings**

"I feel that way too sometimes. Do you want to know what I do when I feel that way?"

**U3 Try coping strategies**

- Take a deep breath
- Make your body feel like jello
- Ask a friend/adult for help
- Go for a walk
- Ask for a hug

**THINK** Be Positive

Your child's doctor may refer you & your child for additional help from a mental health specialist to learn additional coping skills.

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**Figure 5. ADHD JIT handout**

## What you & your child need to know about ADHD

# ADHD

### Attention Deficit Hyperactivity Disorder

**11 %** of kids 4-17 years have ADHD

**Different Types**

- INATTENTIVE TYPE:** Forgetful, hard time staying organized, makes careless mistakes, easily distracted
- HYPERACTIVE/IMPULSIVE TYPE:** Always "on the go", blurts out answers, cannot play quietly, cannot wait turn
- COMBINED TYPE:** all of the above

**Treatment Options**

You & your child's doctor will talk about what combination is best for your child & over time

- Medication
- School Support
- Behavior Therapy
- Parenting Support

**Tips to Help your Child**

Spend quality time with your child without cell phones, computers or TV for at least 10 minutes a day

**Play together**

**Ask about your child's day**

**Read together**

**Go on a walk together**

**Praise your child for making an effort**

"I liked that you put away your toys when I asked. That was helpful!"

"Great job for remembering to put your homework in your book bag. That is being responsible!"

Make eye contact with your child before talking

Give **1** command at a time

Use picture charts to help your child stay organized or remember steps

Spend time outdoors to let some energy out!

**We Can Help You Too**

**Take 1 day at a time & schedule a break for yourself**

**Ask us questions**

**Who is part of your team?**

You, Your Child & Family

Pediatrician

Teacher(s) & Principal

Behavior therapists

Tutors

Sometimes kids with ADHD can have: ANXIETY, LEARNING DISABILITIES, TICS

**WEBSITES FOR MORE INFORMATION**

[www.chadd.org](http://www.chadd.org)

[www.understood.org](http://www.understood.org)

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Additional discussion centered around wanting the SCARED-Child report version in CHICA as many providers voiced wanting the companion screening tool for children to complete. While this was outside the scope of the study, the technical team did add this addition for force printing such that providers wishing to administer the child version could do so in the context of clinical care. This was implemented and released in February 2017 to the intervention clinics.

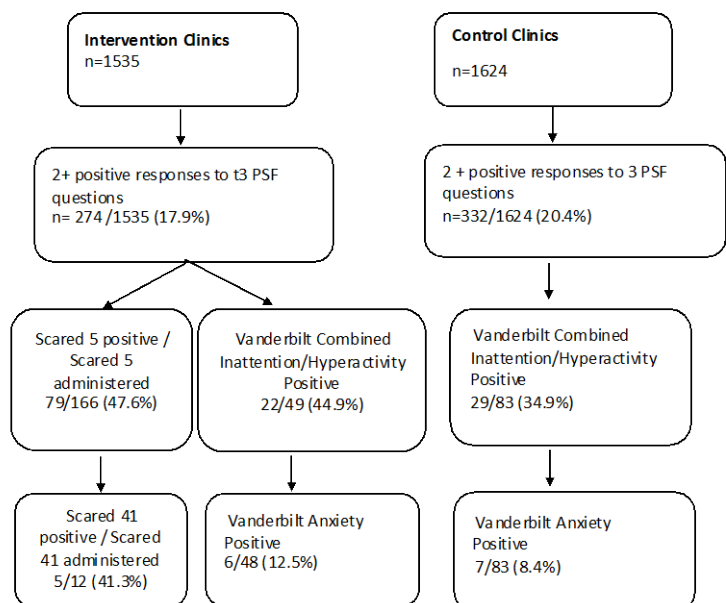
**Phase Two:** Data for this aim comes from a variety of sources as outlined above. Phase two ran from approximately March 23, 2016 to March 22, 2017. An extra 3 months from March 23, 2017 to June 22, 2017 was used when merging CHICA, Regenstrief and Medicaid data to allow time for children to see mental health specialists and fill prescriptions for the time of the index visit. Therefore, the final study data contained data for the cohort of children who were seen at any of the four participating clinics during the 12-month study timeframe whose caregivers endorsed inattentive behaviors and thus activated the revised module (intervention sites) or ADHD module (control sites).

# Study sample demographics/characteristics:

Table 1. \*Unpublished data but will be incorporated into manuscripts for peer-review

		Overall n=3159	Intervention n=1535	Control n=1624	p-value
Clinic	BBPS	301 (9.5)	301 (19.6)	0 (0.0)	
	FMPS	889 (28.1)	0 (0.0)	889 (54.7)	
	PEPS	735 (23.3)	0 (0.0)	735 (45.3)	
	TEPS	1234 (39.1)	1234 (80.4)	0 (0.0)	
Age (years)	N	3159	1535	1624	0.2627
	Mean $\pm$ SD	8.7 $\pm$ 1.9	8.7 $\pm$ 1.9	8.6 $\pm$ 1.9	
	Median(Min, Max)	9.0 (6.0, 12.0)	9.0 (6.0, 12.0)	9.0 (6.0, 12.0)	
Race	American Indian / Eskimo	4 (0.1)	2 (0.2)	2 (0.1)	
	Asian Pacific Islander	20 (0.7)	7 (0.5)	13 (0.9)	
	Black	1629 (59.5)	751 (57.9)	878 (61.1)	
	Hispanic	186 (6.8)	120 (9.2)	66 (4.6)	
	Other/Unknown	465 (17.0)	251 (19.3)	214 (14.9)	
	White	432 (15.8)	167 (12.9)	265 (18.4)	
	missing	423	237	186	
Ethnicity	Not Hispanic	1342 (55.1)	630 (52.8)	712 (57.4)	<b>0.0226</b>
	Hispanic	1093 (44.9)	564 (47.2)	529 (42.6)	
	missing	724	341	383	
Language	English	2094 (66.3)	1018 (66.3)	1076 (66.3)	0.9991
	Spanish	1034 (32.7)	502 (32.7)	532 (32.8)	
	English, Spanish	31 (1.0)	15 (1.0)	16 (1.0)	
Insurance	Advantage	50 (1.7)	30 (2.1)	20 (1.4)	
	Commercial	220 (7.5)	124 (8.6)	96 (6.5)	
	Medicaid	2486 (85.0)	1241 (85.7)	1245 (84.3)	
	Medicare	110 (3.8)	14 (1.0)	96 (6.5)	
	Self-Pay	56 (1.9)	37 (2.6)	19 (1.3)	
	pending	3 (0.1)	2 (0.1)	1 (0.1)	
	missing	235	88	147	

**CHICA Data:** Over the course of the 12-month study period, a total of 3,159 children triggered the inattentive/disruptive behaviors module. Among these, 606 (19.2%) endorsed at least 2 of the 3 PSF items, which prompted the revised module or ADHD module in intervention or control clinics, respectively. Of those 606, 274 (45.2%) were in the intervention group and 332 (47.6%) were in the control group. Only 166 of the 274 (60.6%) were administered the SCARED 5. Of those, 166, 79 (47.6%) were positive for anxiety. Only 12 of the 79 had a SCARED 41 completed and scanned back into CHICA and of those 5 were positive for anxiety. In the same time frame, 132 children in the Intervention and control groups were administered the Vanderbilt. Only 13 were positive for anxiety based on the Vanderbilt co-morbidity subscale. There was no significant difference between groups in the percentage of children with anxiety detected.



The data above show that the clinics had a hard time ensuring that once a SCARED 5 was positive a subsequent SCARED 41 should have been completed and scanned back into CHICA. This did not happen for a variety of reasons (see implementation interviews below). Due to the lack of complete data, our initial objective of comparing rates of anxiety detected by the SCARED 41 versus the Vanderbilt Co-Morbidity scale was unachievable.

There were only 3 instances where the Vanderbilt co-morbidities anxiety screen and the SCARED 41 were not missing. This was not enough to test for difference in percent positive. There were enough cases for testing equality between the Vanderbilt Anxiety diagnosis and the SCARED 5. Here McNemar's test showed that the Scared 5 found a significantly greater percentage of children as positive for Anxiety than did the Vanderbilt (p-value = 0.0047).

Rates of ADHD diagnosis by ICD10 codes were significantly higher in control clinics than in intervention groups. Rates of medication were significantly higher in control clinics than in intervention clinics.

**Table 2. Agreement of SCARED 5 with Vanderbilt Anxiety screen**

Table of Vanderbilt Anxiety by SCARED5			
Vanderbilt Anxiety	SCARED5		
Frequency Percent Row Pct Col Pct	Negative	Positive	Total
Negative	9 31.03 37.50 75.00	15 51.72 60.50 88.24	24 82.76
Positive	3 10.34 60.00 25.00	2 6.90 40.00 11.76	5 17.24
Total	12 41.38	17 58.62	29 100.00
Frequency Missing = 1506			

Caregiver interviews: A total of 16 interviews were successfully completed with 15 in English and 1 in Spanish caregivers. We attempted to contact 80 eligible caregivers to date within the 2-week timeframe post index visit. Fourteen were excluded, mostly because the caregiver either did not remember receiving both Vanderbilt and SCARED 41 at the index visit. Five caregivers declined the interview. Others were considered lost to follow up for failure to complete an interview after a minimum of three attempts within the 2-week period.

A summary of findings from the interviews shows that caregivers had mixed feelings about the process of screening for both ADHD and anxiety:

- Overall suggestions for improving the process of screening: One parent suggested it would be easier if the forms were online. However, seeing both the Vanderbilt and SCARED 41 items, helped her to understand what her child was dealing with. Similarly, a second parent said seeing the form and handout helped her understand how anxiety impacts her child at school and gave her general information about anxiety. Another parent said because of language issues she felt the process would have been improved if someone read the screening forms to her. She did not really understand all the items and ended up giving the form to the medical assistant. This complaint was heard from 3 other parents. One even suggested a glossary would have been helpful because she was not familiar with all the terms. Parents acknowledged that it would be best to complete the forms before leaving clinic (parent forms) but the teacher form (Vanderbilt) had to be done after the visit. A separate parent reported getting the Vanderbilt first and completing it but after the appointment received the SCARED 41 so she had to stay longer to complete it and hand it back to the nurse before leaving.

- Response burden and feedback about the validated screeners: Some of the parents commented on the overall length and time to complete the two screeners at the same visit. She mentioned that it was difficult to complete given that she had ADHD herself and could not concentrate and it takes her longer to read forms. She felt that the process could have been improved if the forms were given earlier in the visit while she was waiting for the doctor (she instead got them as the doctor was coming to see her and her son). One parent specifically said that it was challenging to complete these forms in the room when her two children were with her, given the length and amount of questions. Another parent complained that the items felt redundant/repetitive and noticed questions asking similar things but in different ways. One parent even went so far as to say he felt some of the questions were useless.

Barriers and facilitators towards implementation: Over the course of the study period, the Eskenazi Healthcare system decided to transition from one EHR to another (EPIC). This occurred in the first year of the deployment of the revised module. The study team continued to monitor implementation through weekly CHICA data pulls that were internally monitored, but also visited the clinics in informal quarterly meetings at the CHICA User Group forum at the intervention clinic site to determine specific issues to troubleshoot.

In the Fall 2017, Dr. Bauer decided to design and implement formal interviews with the intervention sites to understand the barriers and facilitators towards implementation. An interview guide grounded in the Consolidated Framework for Implementation Research was developed (Damschroder LJ et al, Implementation Sci, 2009). This framework is meant to guide how implementation is planned, organized and conducted. This framework helps to identify potential influences of implementation and will provide key insights into adaptations across sites and implementation fidelity. Several trained research assistants visited the two intervention sites and conducted these interviews in a focus group setting for ease and convenience of the clinical providers and staff. A total of three focus groups were conducted in September and October 2017: one at each clinic site (MD providers only at one site; MD and staff at second site; co-located mental health therapists that cover both clinics).

A summary of the main findings are included below:

- Providers felt that overall there were issues around design packaging and quality that was both a barrier and facilitator. The pre-screening form (SCARED 5) and the way it was displayed often times was not completed entirely because the way it was displayed on the tablet. This is a problem because if the SCARED 5 is incomplete or not submitted, then CHICA has incomplete data to then decide whether the SCARED 41 is warranted. This is the first key step towards launching the full anxiety work-up (**INTERVENTION CHARACTERISTICS-DESIGN PACKAGING**).

*Sometimes parents thought they were done with all the forms but “the questions that trigger the SCARED 41 where it’s like finished, then it says, who’s here and then it says finished and then it says, oh there’s another questionnaire...and they’re not finished. So that would need to be fixed...that is one of the big issues. So if it was like a flow of questionnaires, it might be easier for families, and then it would trigger more of that SCARED 41.”*

- Providers complained about handouts being printed for conditions they didn’t feel were needed in the moment (such as ADHD) but not enough of the other handouts they wanted to pursue decision making for anxiety (**INTERVENTION CHARACTERISTICS-DESIGN PACKAGING**).

*“I feel like sometimes I get a lot of Vanderbilt type things print out or patients are already on medicines and doing well on them and then I don’t feel like I get as many of the SCARED 41s. I feel like I get a lot of maybe depressed, isn’t having any fun and then when you ask them a little more then we ask different kinds of SCARED 41 [items] which may not be positive but it just seems like I don’t seem to get a lot of the extra print out for that, anxiety.”*

- Providers were overwhelmingly concerned about compatibility issues. Having two long screening instruments printed for ADHD and Anxiety in the same visit in limited visit time and needing to minimize disruptions to workflow were an issue (**INTERVENTION CHARACTERISTICS-DESIGN PACKAGING and COMPATIBILITY**).

*“Seems to overcall some things a bit, like giving you handouts that you don’t necessarily need for things like ADHD, I’ve noticed the same issue where you get a lot of Vanderbilts and we’re not necessarily needing to re-administer them, but I do think it’s really been useful for me with the SCARED screener and the SCARED 41. I think like anything else, asking for more questionnaires in the office is sometimes asking a lot of patients especially when they’ve got like three other younger kids in the room bouncing off the walls, running around and the last thing you want to do is fill out another questionnaire and of course the return is low if not non-existent, when they take them home.”*

However, some providers use the ability to forceprint the SCARED 41 or associated handouts to ensure they have what they need in the moment:

*“Once I discover they potentially might have [anxiety], I go ahead and trigger the SCARED form...so it hasn’t been anything that they filled out on a tablet that actually flags them, more so me going through the evaluation process and then recognizing that they potentially need additional help and trigger the system that way.”*

However, **COMPATIBILITY** was a major obstacle towards implementation, especially at one of the sites as it was larger, had more providers and more volume:

*“The problem is because of our workflow and we are short on nursing and MA staff and they’ve been asked to do a lot more, we eliminated the stopping at the CHICA to get all that paperwork and we’re really doing a whole lot more of regenerating what we think we need from the pre-rounding and what comes up during the visit, so unfortunately the auto-prompt at the next visit isn’t going to be helpful for us.”*

*“Ever since we’ve come to EPIC, CHICA has taken a back seat. I think that partly because it’s a new experience for all of us that we had to adapt to, some of us are a little less technologically savvy than others. And so, the information is often duplicated in CHICA that we can already get in EPIC and so figuring out a way to make it more relevant to us [is needed].”*

- Providers did feel that the module helped remind them to consider anxiety much more than in the past (**RELATIVE ADVANTAGE**):  
*“Even when we haven’t gotten those SCARED 41s filled out, I think it’s helped to put patients a little more on the radar of being sure they’re getting the right comprehensive care with getting into child psych if need be or I think it’s probably resulted in my augmenting my referral base just a little bit from that standpoint, being sure those kids are getting the care that they need.”*
- When handling mental health issues, pediatric providers are grateful for the expertise of co-located mental health therapists, whether or not they have or use CHICA (**COSMOPOLITANISM**):  
*“One of our advantages here is we have that here at Midtown. . . and so a lot of the times if we suspect anxiety, I just go to Midtown. And so that probably also skews our results because we have in person assistance so we’re going to access that more often or as often as we can.”*
- All providers felt screening for anxiety was important and having something in CHICA to remind them was valuable (**RELATIVE PRIORITY**).  
*“I think it’s really good because universal screening has been a priority goal for primary care and we haven’t had, it’s just hard to find a tool...It’s really nice to have a screening tool for anxiety that we can use for the anxiety component, so I think that’s good.”*

Physician action in response to a positive screen: Overall the usage of the revised module remained low throughout the study period. There are a few reasons for this: 1) In October 2017 the Eskenazi Health system decided to adopt a new EHR (Epic). During this transition training time, providers’ schedules were decreased for a period of 3 weeks. While CHICA programmers had established the ability for CHICA to “talk” with Epic, the interface was not automatic and required providers to take 6-7 extra clicks while accessing Epic. Unfortunately, many of the providers voiced frustration

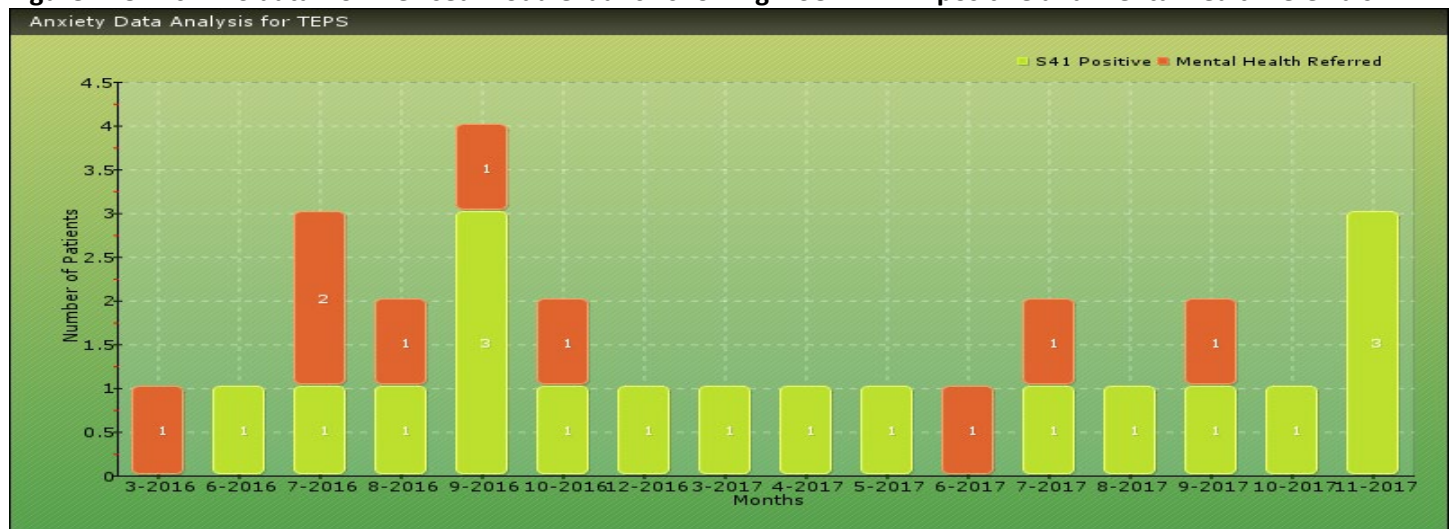


about the time required to open CHICA or get it to run seamlessly and thus some providers who regularly used CHICA pre-Epic experienced consistent challenges in trying to establish their new workflow, while being asked to see a high volume of patients. In the end, some elected to no longer use CHICA. Others tried resuming using CHICA to varying success, voicing continued challenges to workflow but continuing to actively try to use CHICA during patient encounters. Others were able to resume CHICA use after becoming accustomed to using Epic. The study team continued to meet with providers throughout the study period and provided run charts of proportion of children with SCARED 5 and SCARED 41 administered as well as once SCARED 5 or 41 positive, actions taken by the provider.

**Figure 6. Clinic TEPS data from revised module launch showing # of SCARED 5 administered, SCARED 5 positive and SCARED 41 positive**



**Figure 7. Clinic TEPS data from revised module launch showing # SCARED 41 positive and mental health referrals**



**Figure 8. Clinic BBPS data from revised module launch showing # of SCARED 5 administered, SCARED 5 positive and SCARED 41 positive**



**Figure 9. Clinic BBPS data from revised module launch showing # SCARED 41 positive and mental health referrals**



To date, among the intervention clinics, when the SCARED 41 positive, 3 of the 5 children were referred to mental health. We examined actions for when the SCARED 5 was positive (given the high degree of missing data of the SCARED 41). The following actions were taken:

- 68 (86.1%) had no action taken
- 1 (1.3%) refused mental health care
- 5 (6.3%) were referred to mental health
- 1 (1.3%) was referred to mental health and given a handout on anxiety
- 4 (5.1%) were given a handout on anxiety

**Table 3. Comparison of Rates between Intervention and Control in the Year prior and in the study year**

		Year Pre Study				Study Period p-value			
		Control Clinics	Intervention Clinics	Odds Ratio (95% CI)	p-value	Control Clinics	Intervention Clinics	Odds Ratio (95% CI)	p-value
<b>Numbers of Children</b>		1804	1662			1624	1535		
<b>2 of 3 PSF questions Positive</b>	No	1427(79.10)	1367(82.25)			1292(79.56)	1261(82.15)		
	Yes	377(20.90)	295(17.75)			332(20.44)	274(17.85)		
<b>Vanderbilt Combined</b>	No	50(56.82)	46(49.46)	1.34 (0.93, 1.94)	0.1192	57(66.28)	40(63.49)	1.13 (0.88, 1.44)	0.3457
	Yes	38(43.18)	47(50.54)			29(33.72)	23(36.51)		
<b>Vanderbilt Hyperactive</b>	No	37(42.05)	42(45.16)	0.88 (0.71, 1.09)	0.2454	44(51.16)	38(60.32)	0.69 (0.50, 0.93)	0.0166
	Yes	51(57.95)	51(54.84)			42(48.84)	25(39.68)		
<b>Vanderbilt Inattention</b>	No	77(87.50)	80(86.96)	1.05 (0.88, 1.26)	0.5852	50(58.14)	34(53.97)	1.18 (0.80, 1.73)	0.3858
	Yes	11(12.50)	12(13.04)			36(41.86)	29(46.03)		
<b>Vanderbilt Anxiety</b>	No	52(59.09)	47(51.09)	1.38 (0.86, 2.20)	0.1756	79(91.86)	55(90.32)	1.20 (0.57, 2.53)	0.6318
	Yes	36(40.91)	45(48.91)			7(8.14)	6(9.68)		

As of December 11, 2017: The number of force prints of any SCARED 41 English or Spanish, Parent or child were approximately 59 for TEPS clinic and 6 for BBPS clinic. Reasons were presumably for needing/wishing to administer the CHILD SCARED, if the parent forgot to complete the form/lost or missed by clinic staff.

**Table 4. Rates of ICD10 diagnoses codes and rates of medications**

Rates	Overall	Intervention	Control	p-value
ADHD	214 (6.8)	77 (5.0)	137 (8.4)	<b>0.0001</b>
DBD	148 (4.7)	67 (4.4)	81 (5.0)	0.4486
Anxiety	82 (2.6)	47 (3.1)	35 (2.2)	0.1176
Depression	15 (0.5)	8 (0.5)	7 (0.4)	0.7987
Medication	139 (4.4)	50 (3.3)	89 (5.5)	<b>0.0023</b>



**Table 5. Comparison of Rates between Intervention and Control in the Year prior and in the study year**

		Year Pre Study				Study Period p-value			
		Control Clinics	Intervention Clinics	Odds Ratio (95% CI)	p-value	Control Clinics	Intervention Clinics	Odds Ratio (95% CI)	p-value
<b>Numbers of Children</b>		1804	1662			1624	1535		
<b>2 of 3 PSF questions Positive</b>	No								
		1427(79.10)	1367(82.25)			1292(79.56)	1261(82.15)		
	Yes								
		377(20.90)	295(17.75)			332(20.44)	274(17.85)		
<b>Vanderbilt Combined</b>	No	50(56.82)	46(49.46)	1.34 (0.93, 1.94)	0.1192	57(66.28)	40(63.49)	1.13 (0.88, 1.44)	0.3457
	Yes	38(43.18)	47(50.54)			29(33.72)	23(36.51)		
<b>Vanderbilt Hyperactive</b>	No	37(42.05)	42(45.16)	0.88 (0.71, 1.09)	0.2454	44(51.16)	38(60.32)	0.69 (0.50, 0.93)	0.0166
	Yes	51(57.95)	51(54.84)			42(48.84)	25(39.68)		
<b>Vanderbilt Inattention</b>	No	77(87.50)	80(86.96)	1.05 (0.88, 1.26)	0.5852	50(58.14)	34(53.97)	1.18 (0.80, 1.73)	0.3858
	Yes	11(12.50)	12(13.04)			36(41.86)	29(46.03)		
<b>Vanderbilt Anxiety</b>	No	52(59.09)	47(51.09)	1.38 (0.86, 2.20)	0.1756	79(91.86)	55(90.32)	1.20 (0.57, 2.53)	0.6318
	Yes	36(40.91)	45(48.91)			7(8.14)	6(9.68)		

Overall, here you see that the rates of diagnosis of ADHD and medication prescription were HIGHER in control clinics than in INTERVENTION clinics over the course of the study. This may be due to the fact that the REVISED module was implemented in intervention clinics. While the use of the revised module was inconsistent due to a variety of implementation barriers and facilitators, the revised module and interactions with the study team at the CHUGs may have been enough to remind providers to think about anxiety as a possibility and to utilize those resources (or Midtown) more often to tease out ADHD from anxiety. However, the difference in anxiety among intervention and control was non-significant based on administrative claims. You can see that in general, the rates of detecting and assigning an ICD-10 code for ADHD was significantly higher compared to rates for anxiety or depression, both of which are historically harder to detect but may be under-diagnosed. The American Academy of Pediatrics (AAP) is making a concerted effort to help general pediatricians to support the detection of behavioral and mental health conditions among children through revised and updated clinical guidelines, resources such as the AAP Screening Technical Assistance and Resource (STAR) Center and mental health toolkit and web based videos to improve provider competency.

## LIST OF PUBLICATIONS AND PRODUCTS

Bauer NS, Yoder R, Carroll AE, Downs SM. Racial/ethnic differences in the prevalence of anxiety using the Vanderbilt ADHD Scale in a Diverse Community Outpatient Setting. J Dev Behav Pediatr. 2016 Oct;37(8):610-8. Doi:10.1097/DBP.0000000000000330. PMID: 27541582.

*The study team is preparing a peer-reviewed manuscript a final manuscript of the results described above in one manuscript. The team feels that there is not enough to separate these into separate papers given the importance of understanding the context of implementation and final results.*